

moderately elongate, not compressed, pilose; basal joint of the posterior short, second and fifth of about equal length. Front *coxæ* large, prominent, and contiguous; the middle pair widely separated. *Sternal lamina* large and plane, tapering from the base of the metasternum to beyond the middle *coxæ*. *Mesosternal process* vertical and short, its suture curvate.

This is nearly allied to *Hydrostygnum*, but may be readily distinguished therefrom by the large prominent *coxæ*. The antennæ differ and the club is shorter and broader, and the maxillary palpi are less slender.

*Thomosis guanicola*, sp. n.

*Oblong-oval*, nude, moderately nitid, nigro-piceous; legs and lateral margins pitchy red; palpi and antennæ usually testaceous; body closely and moderately finely punctured.

*Head* not half the width of the thorax, longer than broad, subconical. *Thorax* almost twice as broad as it is long, regularly curvedly narrowed towards the front, lateral margins well developed. *Scutellum* triangular. *Elytra* with ten series of distinct but not coarse punctures on each; the sutural at the apex almost form striæ.

*Underside* nigrescent, mostly densely and finely sculptured, with short, inconspicuous, dark ashy pubescence. *Abdomen* with five segments, the three central nearly equal, the basal subcarinate along the middle.

Length  $3\frac{1}{2}$ , breadth  $1\frac{3}{4}$  lines.

Bounty Islands.

Found by Mr. L. Cockayne feeding on deposits of guano.

Auckland, New Zealand,  
27th August, 1903.

XL.—*Niphargus Kochianus*, Bate, in an *Irish Lake* and *N. subterraneus*, Leach, in *Kent*. By W. F. DE VISMES KANE, M.R.I.A.

[Plate VIII.]

THE following notes on the occurrence of one of these blind crustaceans in the open waters of Lough Mask will be of value, especially as in many respects they tend to confirm certain opinions held by Forel, Humbert, and others in connexion with allied species of Amphipoda. Several genera and many

species of small blind Crustacea, both Isopoda and Amphipoda, are known to inhabit wells and caves in many parts of the world. Chilton has described no less than six from New Zealand, Packard and Cope several from North American cave-waters, while those of France, Switzerland, and elsewhere in Europe have occupied the attention of numerous zoologists.

*Niphargus* and the nearly related *Crangonyx* have been referred by some early authors to *Gammarus* as the ancestral type, of which the most familiar species is *Gammarus pulex*, the common "freshwater shrimp." But careful examination of the respective generic characters has resulted in a general consensus of opinion that these blind subterranean genera have originated from some extinct freshwater ancestor with eyes, from which *Gammarus* has also descended, so that they are not merely modified and degenerate Gammarids. And this view has certainly been strengthened by the discovery of an eyed form of *Crangonyx* (*gracilis*, Smith) in Lake Superior, while others have been found in surface-streams in America, and in Tasmania a nearly related form, also with eyes, has been noticed. More than one species of *Niphargus* with perfect eyes are known too from the Caspian and Black Seas. It seems, therefore, extremely probable that the blind subterranean Crustacea descend from widely distributed freshwater eyed forms, some of which are still extant. In English wells, especially in the southern counties, several blind forms of *Niphargus* and one *Crangonyx* are known to occur. Only recently the writer obtained specimens of *N. subterraneus*, Leach, and probably *N. fontanus* (*puteanus*, Koch), from deep wells near Lynsted, Kent. But in Ireland, so far, only *N. Kochianus*, Bate, from a well near Dublin, has been recorded. This species has never been hitherto found in an open sheet of water. Two other blind species have, however, been found in freshwater lakes: namely, *N. orcinus*, discovered in 1868 by Gustav Joseph in the Lake of Zirknitz, where he reports them to be plentiful and that they come to the surface in fine weather after sunset. They frequent the brooks flowing from the hill-grottoes of Carniola, whence he supposes them to have descended into the lake. Another, *N. subterraneus*, var. *Forelli*, found by Prof. Forel in the deep waters of Lake Lemán, has been carefully described by Alois Humbert. It was subsequently discovered in five other Swiss lakes, and both Forel and Humbert eventually came to the conclusion that they found their way thither from subterranean sources, and got acclimatized to their new habitat. The phenomenon of hereditary blindness

which these and similarly situated animals display has been the subject of much discussion among biologists, of whom Packard and Semper may be mentioned, some holding that the effect of disuse of the organ has brought about its partial or total degeneration, others that in localities where light prevails the individuals with perfect vision would survive those with defective sight, and that natural selection would secure the maintenance of these valuable organs; but that where darkness makes the possession of sight in no way advantageous to the possessor the eyed and eyeless forms would breed together and have equal chances in the struggle of life, with the result that every degree of atrophy of the parts of the eye might be expected to supervene till a totally blind race resulted.

Examples illustrating each stage of this degeneration have been discovered in such situations. Leydig, writing of the blind *Niphargus subterraneus*, mentions the fact that some specimens have been observed with pigment-spots in the region of the eye, and states that he has found that though the optic ganglion is present the eye is wanting. Chilton remarks of the subterranean blind species of New Zealand that in only one species has he discovered any external traces of eyes, namely two or three small lenses without pigment\*, and he thinks it probable that in different species there may be great differences in the amount of degeneracy of the eyes, and perhaps also in individuals from different localities.

A lake form of the common *Gammarus pulex* at Wälen-schwyl was found by Prof. Asper to have both blind and eyed forms at a depth of 40 metres. Similar facts have been adduced by other authors in regard to lake varieties of the Isopod *Asellus* &c. Packard, in his description of the cave-fauna of North America, mentions that in the genus *Cecidotrea* one species is without even a vestige of an eye, though in others there are imperfect traces. It is therefore interesting that among about 130 specimens of *Niphargus Kochianus* from Lough Mask I found three which had well-developed pigmentation, and a fourth which showed a cloudy shading in the optic region. But, in the absence of opportunity to have careful sections made by a competent zoologist, it is impossible to say how far the structure of the eye may be preserved in these specimens. The absence of colour is likewise another general characteristic of subterranean fauna.

\* "Subterranean Crustacea of New Zealand," C. Chilton, Trans. Linn. Soc., 2nd ser. Zool. vol. vi. pt. 2, p. 220.

But it is remarkable that in considerable oceanic depths a strange uniformity of orange coloration obtains among Crustacea, Hydroids, and other marine organisms, a remarkable instance of which the writer once had the opportunity of observing. Chilton, quoting from Prof. S. I. Smith on this phenomenon, goes on to say that he has been unable to find any parallel instances of this that are in any way conclusive with regard to the animals found in the deep waters of lakes, such as those of Switzerland. In the present case, therefore, the orange colour of the Lough Mask *Niphargus* is notable. Specimens from the Dublin well are diaphanous.

The following are the circumstances of the capture:—In the last days of June 1903 I made an expedition to Lough Mask, in the county of Mayo, with the object of pursuing investigations as to its Entomostracan fauna and also in the hope of finding *Mysis relicta*. I brought with me a kind of dredge designed especially for use in freshwater lakes, by the aid of which I had captured that crustacean in abundance in Lough Neagh and Lough Erne. By the kindness of Col. Knox, of Creagh, I was provided with a suitable boat and man, and spent the greater portion of a day dredging the deeper parts of that picturesque lake in depths varying from about 100 to 150 feet. No *Mysis* were taken. By adjusting its mouth I was able either to pass the net at a height of about 1. inch above the level of the floor of soft mud, or to skim it so closely at other times in the hope of taking Ostracoda as to pick up a little of the upper layer of loose débris, much of which I believe consisted of fish-excrement. All this was reserved for future examination, and a sample of the mud itself taken up by reversing the dredge. On examining this material I noticed a few minute Amphipoda of an orange colour which from time to time appeared on the surface of the muddy water and then burrowed out of sight. They swam sideways, like *Gammarus*, but when undisturbed crawled in an upright position. Of these I secured a small series, which were duly despatched by post to the Rev. Canon Norman, whose kind assistance on similar occasions has been frequently afforded me; and subsequently he wrote that he was much interested in my find, which was a blind *Niphargus*, and that it would be of importance to secure a long series if possible, because some of the specimens were mutilated by the loss of the terminal uropoda, and it was desirable to ascertain the sexual characters. About six weeks later, therefore, I made a second journey to the west, and again experienced the kind hospitalities of Creagh. The result was highly satisfactory, for in two days, the first of which was so stormy that I only with

some risk reached the dredging-grounds, and could venture only two short hauls of the dredge, I secured about 130 examples at a depth of from 130 to 150 feet, some of which were only about 2 mm. long and of a paler orange than the larger specimens, probably being younger. The phenomenon of the existence of these blind Crustacea, usually inhabitants of subterranean waters, made me desirous of testing the adjacent Lough Corrib also for these animals, as I was aware that the two lakes have underground communications. Accordingly I spent two days (the 13th and 14th August) on the latter, which off Cong, where the outflow of Lough Mask enters it, reaches its deepest soundings, one other area on the western shore some miles away only excepted. I therefore dredged along the shore of the narrow isthmus which divides the two sheets of water, in the bays, and also in moderate depths of 60 to 70 feet bordering the shore, for a distance of about two miles, but without success. I then tested the depths further out in the lake, with the unexpected result that a moderate number of *Mysis relicta* rewarded my efforts, but not a single *Niphargus*. These deeper soundings reached from 110 to 132 feet, and the floor of the lake varied from soft mud to a hard gravelly bottom, with occasional stones. The results of my researches, therefore, though highly gratifying, were exactly the reverse of my expectations. Searching for *Mysis* in Lough Mask, I took *Niphargus Kochianus*, and following up what I thought to be its probable extension to Lough Corrib, I met with *Mysis relicta*, both of them remarkable captures.

The question arises as to the origin of this normally subterranean species in the open waters of a lake. Two allied species, as already mentioned, have been described from similar localities on the Continent, and both of them were presumed to have been derived from underground sources, that from the Lake of Zirknitz presenting little room for doubt. A similar explanation for the presence of *Niphargus Kochianus* in Lough Mask is available. The northern and eastern shores of this picturesque sheet of water are for the most part flat, with only slight undulations, and consist of horizontal strata of carboniferous limestone, which extend south along Lough Corrib to Galway. As is well known, the rain-water accumulating in its hollows and fissures has, in the course of ages, dissolved the softer strata and formed underground channels and reservoirs, sometimes of great extent and miles in length. Many such subterranean waters find their way into, and others take their rise from, Lough Mask. Its western shore, however, is of igneous

rock, and the granitic chain of the Partry Mountains rises from it steeply into heather-clad summits, the last and most northerly of which is drained on its further side by streams which, wandering down into the limestone lowland, sink into the rock and pursue an unseen course for long distances, till, rising again, they fall into the lake. The number of these subterranean sources at the northern end I am not able to state with certainty, but their volume is considerable. On the S.E. shore, about half a mile from the lake, I visited a natural cavern through which a stream passes, but from whence or whither no one can say. Further to the south, in a bay not far from Lough Mask Castle, the waters of the lake flow with a strong current against the base of a terraced ridge of limestone, which rises in gradual escarpments from the verge, and the roar of the disappearing currents can be distinctly heard among the fissured crags. These effluent waters doubtless find their way into Lough Corrib, which is only separated by a low isthmus, about two miles broad, of limestone, through and under which channels exist which void their waters in several magnificent fountains under a cliff near Cong. I look forward to some future opportunity of investigating these interesting districts and the subterranean fauna which they doubtless contain.

With regard to the *Niphargus*, which was finally determined by Dr. Norman to be *Kochianus*, Bate, very little has hitherto been published respecting its sexual characters. Spence Bate, who first described the species\*, had but a single specimen, which had lost the terminal uropoda. He states that the posterior pair of pleopoda were missing, but, to judge from the figure, all three seem to have been mutilated. Chilton also, in his description of this species, states that for want of a sufficient series for comparison he was unable to put forward any statement of sexual characters. The long series now available from Lough Mask somewhat explains the difficulty, as they show that the notable difference in shape and size which characterizes the uropoda of the two sexes in other species of *Niphargus* does not exist in *N. Kochianus*, and that therefore they are of little use in the determination of sex. In fresh specimens, however, those of the female seem somewhat more robust and are slightly shorter than those of the male; but the average difference in length is too inappreciable for the purpose of identification, by itself, of individuals. Moreover, the proportion of their length to the body seems to vary among examples of the same sex. This

\* Nat. Hist. Review, 1859, vol. vi. Proc. Soc. p. 165.

may perhaps be accounted for by the difficulties of alimentation, which in some instances would result in the stunted size of adults, whose organs might be proportionally longer than younger but well-nourished individuals of the same body-length. The following table will illustrate this. The length of body is measured from the extremity of the head to the base of the third uropod. The figures given are hundredths of an inch.

Males (probably).		Females (probably).	
Body length.	Length of uropod.	Body length.	Length of uropod.
16·5	2·5	15	2
14·5	2·5	14	2·2
14·5	2·3	14	2
12·5	2		
11	2		

The position of the telson relatively to that of the body and third uropod seems to me some index to the sex. In going through a long series I noticed that in normal attitudes with the body fairly extended the telson of the female lies parallel to, and often rests upon the uropod, but in the male it stands more erect and at right angles to the body-segment. The posterior (fifth) pair of pereopods are proportionally longer in the female, reaching to the middle, or in large specimens even beyond the extremity of the third uropod, when the body lies straight and the appendage is drawn backwards parallel to it. In the male they scarcely reach the base of the uropod. The brood-plates of the adult female are, of course, when they can be detected, the most certain indication of that sex. One additional observation remains to be added. In dissecting the buccal apparatus I found entangled in the setæ of the first maxillary palp a specimen of *Chydorus ovalis*. Those observers who have examined the contents of the intestinal canal of species of *Niphargus* report it to consist chiefly of sandy débris and portions of algæ. The presence of an entomostracan in the mouth-organs certainly proves nothing, but the presumption is that these creatures may feed on animal as well as on vegetable tissues, when they are available. My experiments with *N. subterraneus* and *Kochianus* substantiate this.

#### *Niphargus subterraneus*, Leach.

In the same autumn I made some investigations on the chalk tablelands above Sittingbourne, Kent. Here deep excavations are necessary to tap a spring. The results were

highly interesting. Specimens of *Niphargus* occurred in five out of eight wells examined in the vicinity of Lynsted to about three miles westward. I could not perceive their relative depths to be a factor in determining the presence of these blind Amphipods, as will be seen by the following synopsis of results :—

- No. 1.—About 120 feet deep. *N. subterraneus* fairly numerous and from 3 to 13 mm. in length of body. The larger individuals, over 8 mm., were captured in a different manner, and I took them to be *N. fontanus*. Numerous Protozoa were present and *Cyclops fimbriatus*, and also the dead bodies of flies, beetles, and other insects in scanty numbers. Probably these as well as algæ, of which, however, I secured none, may have provided food. Several blind springtails from the walls were secured.
- No. 2.—About 150 feet deep and  $\frac{3}{4}$  mile distant. Had been emptied and cleaned the previous year. Only *Cyclops fimbriatus* and specimens of a minute diaphanous worm with pink intestines were found.
- No. 3.—Near no. 1, about 60 feet deep. A springtail only.
- No. 4.—About  $\frac{3}{4}$  mile distant, 80 feet deep. What I took to be *N. fontanus*, Bate, was fairly numerous and about  $\frac{1}{2}$  inch long. Five of them measured 9, 10, 10, 13, 14 mm. respectively. The Ostracod *Cypria ophthalmica* was here extremely numerous, with eyes as well developed as in a surface specimen. *Cyclops fimbriatus* and a pseudoscorpion (from wall probably) completed the list, beside various drowned insects.
- No. 5.—About  $1\frac{1}{2}$  mile from no. 1, 160 feet deep or thereabouts, and of very wide diameter. Among much débris only six *N. subterraneus* 2 to 5 mm. were taken. Also *Cyclops fimbriatus*, two pseudoscorpions apparently the same species as the above, *Cypria ophthalmica* numerous, and one blind springtail.
- No. 6.—About  $2\frac{1}{2}$  miles distant, 150 feet deep. Six *N. subterraneus*, 2–4 mm.
- No. 7.—Near the former, about 100 feet deep. A few *N. subterraneus* of similar small size.



No. 8.— $3\frac{1}{2}$  miles from no. 1, over 380 feet deep. The bottom full of chalky detritus stained deeply with oxide of iron. No *Niphargi* captured. One *Cyclops serratulus*, var. *varius*, ♀; two *Cyclops viridis (gigas)* probably, but the fifth feet not discernible; two pseudoscorpions. Wings and relics of insects numerous.

There could be no question as to the species of the smaller specimens of *N. subterraneus* taken in these investigations; but on the third attempt made in no. 1 well I left a net baited with meat all night. All the resulting specimens differed considerably in some respects from the series of small ones taken previously, notably in the gnathopoda, of which the propodos was less quadrangular in shape, the dactylos much more oblique, and the postero-ventral angles of the pleon-segments more acute. The first pair of gnathopoda had the propodos so approximately pear-shaped (see Pl. VIII. fig. 4) that I concluded this larger series to belong to *N. fontanus*, Bate. The series taken in the ordinary manner in the daytime from no. 4, which were all large, proved to be similarly characterized, and no small individuals being among them, I concluded the *Niphargi* of this well must belong to the same species as the last captures in no. 1. One of these, however, submitted to Canon Norman was considered, however, by him as referable to *N. subterraneus*, Leach, although he acknowledged that the existence of the above-mentioned characters made the diagnosis less certain. It was also sent to M. Chevreux, who has recently figured a *Niphargus* from France as *N. fontanus*, Bate, and he, I understand, identifies it as identical. However, Canon Norman's suggestion (*in litt.*) that large specimens possibly developed these divergences of characteristics seems borne out by my more critical examination subsequently of the whole series taken; and a reference to the figures will show that, though the first gnathopoda of specimens about  $\frac{1}{2}$  inch long are somewhat pear-shaped and the palm more oblique, yet they do not exactly correspond to the figures given of *N. fontanus* by Spence Bate (Nat. Hist. Rev. vol. vi. Proc. Soc. p. 164). If Bate's figure was not very accurately engraved it might possibly represent a mature stage of *N. subterraneus*, Leach,—a conclusion I am inclined to adopt, the more because the proportions of the pleopoda seem to be abnormally curtailed in the figures given by him both of *N. Kochianus* and *N. fontanus*. Further researches may possibly elucidate the truth, and it seems possible that wells

situate in the lower levels and valleys of Kent may yield even larger and more interesting results when I have the opportunity of resuming the investigation.

## EXPLANATION OF PLATE VIII.

*N. Kochianus*, Bate, from Lough Mask.

Fig. 1. Terminal uropoda, male and female (to scale).

Fig. 2. Mandible.

Fig. 3. Posterior lip.

*N. fontanus*, Bate (?), = *N. subterraneus*, Leach.

Fig. 4. Gnathopod of first pair.

Fig. 5. Second pair of gnathopoda.

From a specimen half an inch in body-length from no. 4 well, near Sittingbourne, Kent.

XLI.—On some new Species of Silver-Pheasants from  
Burma. By EUGENE W. OATES.

AMONGST the Pheasants that I have received from Burma during the last two years there are three well-marked new species of Silver-Pheasants. The first two that I shall describe belong to an entirely new section of these birds, in which the males combine a black wing with a barred tail, and the females have the middle tail-feathers with the two webs of different colours. The third species is of remarkable interest, as it has now been rediscovered after an interval of eighty years. The bird was, however, never described nor named, and it was only known from a coloured drawing.

*Gennæus obscurus*, sp. n.

In the adult male the head, crest, and the whole lower plumage are glossy blue-black. The hind-neck, mantle, back, and all the upper wing-coverts are bluish black, sparingly speckled with pale buff. The rump-feathers and upper tail-coverts are bluish black, broadly margined with white and very sparingly dotted with pale buff on one or both webs. The primaries are brown; the secondaries black, with a few buff specks on the margin of the outer web of each feather. The outermost tail-feather is black; the middle pair black with narrow, broken, diagonal white bars on the whole of both webs, except the terminal quarter of the outer web, the margin of the basal half of the inner web